

In the Claims

1. (Currently amended) An aqueous-based removal composition ~~useful for removing photoresist, bottom anti-reflective coating (BARC) materials, and/or gap fill materials from a substrate having such material(s) thereon, said composition comprising a fluoride source, at least one organic amine, at least one organic solvent, water, optionally at least one chelating agent, and optionally at least one surfactant, wherein said composition is useful for removing photoresist, bottom anti-reflective coating (BARC) materials, and/or gap fill materials from a substrate having such material(s) thereon.~~

2. (Currently amended) The composition of claim 1, ~~comprising the following components based on total weight of the composition: wherein the at least one organic amine comprises N-(2-cyanoethyl)ethylenediamine~~

~~0.1 % wt. 15.0 % wt. fluoride source;~~

~~20.0 % wt. 60.0 % wt. total organic amine;~~

~~1.0 % wt. 60.0 % wt. total organic solvent;~~

~~20.0 % wt. 70.0 % wt. water;~~

~~optionally 0.000 % wt. 20.0 % wt. chelating agent; and~~

~~optionally 0.000 % wt. 5.0 % wt. surfactant,~~

~~wherein the total of the weight percentages of such components of the composition does not exceed 100 % by weight.~~

3. (Currently amended) The composition of claim 2 1, wherein the fluoride source comprises a fluoride-containing compound selected from the group consisting of ammonium fluoride, hydrogen fluoride, ammonium bifluoride, tetraalkylammonium difluoride, alkyl phosphonium difluoride, and triethylamine trihydrofluoride.

4. (Currently amended) The composition of claim 2 1, wherein the fluoride source comprises ammonium fluoride.

5. (Currently amended) The composition of claim 2, ~~wherein the at least one organic amine comprises an amine containing compound selected from the group consisting of hydroxyethylpiperazine, hydroxypropylpiperazine, aminoethylpiperazine, aminopropylpiperazine, hydroxyethylmorpholine, hydroxypropylmorpholine, aminoethylmorpholine, aminopropylmorpholine, triethanolamine, pentamethyldiethylenetriamine, dimethylaminoethoxyethanol, aminoethoxyethanol, ethylene urea, trimethylaminoethylethanolamine, trimethylaminopropylethanolamine, N-(2-cyanoethyl) ethylenediamine, and N-(2-cyanopropyl) ethylenediamine further comprising at least one additional organic amine.~~

6. (Currently amended) The composition of claim 2 5, wherein the at least one additional organic amine comprises an amine-containing compound selected from the group consisting of ~~hydroxyethylmorpholine and N-(2-cyanoethyl) hydroxyethylpiperazine, hydroxypropylpiperazine, aminoethylpiperazine, aminopropylpiperazine, hydroxyethylmorpholine, hydroxypropylmorpholine, aminoethylmorpholine, aminopropylmorpholine, triethanolamine, pentamethyldiethylenetriamine, dimethylaminoethoxyethanol, aminoethoxyethanol, ethylene urea, trimethylaminoethylethanolamine, trimethylaminopropylethanolamine, and N-(2-cyanopropyl) ethylenediamine.~~

7. (Currently amended) The composition of claim 2 1, wherein the at least one organic solvent comprises a compound selected from the group consisting of 1,4-butanediol, 1,3-butanediol, ethylene glycol, propylene glycol, N-methyl-2-pyrrolidone, DMSO, γ -butyrolactone, propylene glycol monomethyl ether, propylene glycol monomethyl ether acetate, diethyleneglycol monobenzylether, ethyl lactate, ammonium lactate, and dimethyl acetamide.

8. (Currently amended) The composition of claim 2 1, wherein the at least one organic solvent comprises propylene glycol monomethyl ether.

9. (Currently amended) The composition of claim 2 1, comprising chelating agent.

10. (Original) The composition of claim 9, wherein the chelating agent comprises a compound selected from the group consisting of iminodiacetic acid, boric acid, ammonium borate, ammonium tetraborate, gluconic acid, mannitol, and sorbitol.

11. (Currently amended) The composition of claim 2 1, comprising surfactant.

12. (Original) The composition of claim 11, wherein the surfactant comprises a compound selected from the group consisting of: (C₁-C₁₅) alkyl glucosides; (C₁-C₁₅) alkyl ethylene oxide/propylene oxide; (C₁-C₁₀) alkyl phenoxy ethylene oxide/propylene oxide; and oxirane, methyl-, polymer with oxirane, ether with 2, 2'-(oxidoimino)bis(ethanol) (2:1) and N(-3-(C(-11-isoalkyloxy)propyl) derivatives.

13. (Original) The composition of claim 11, wherein the surfactant comprises a compound selected from the group consisting of decyl glucoside, AO-405, AO-455, CA-520, CO-630, CA-720 and CO-890, CO-210, CO-520, CO-990 and DM-970.

14. (Canceled)

15. (Currently amended) The composition of claim 2 1, selected from the group consisting of Formulations A-E F, wherein all percentages are by weight, based on total weight of the formulation:

Formulation A

about 8 % NH₄F/HF;

about 30 % hydroxyethylmorpholine;
about 7 % N-(2-cyanoethyl) ethylenediamine;
about 15 % propylene glycol monomethyl ether;
about 40 % de-ionized water; and
about 0.05 % decyl glucoside;

Formulation B

about 8 % NH₄F/HF;
about 30 % hydroxyethylmorpholine;
about 7 % N-(2-cyanoethyl) ethylenediamine;
about 25 % propylene glycol monomethyl ether; and
about 30 % de-ionized water;

Formulation C

about 8 % NH₄F/HF;
about 30 % hydroxyethylmorpholine;
about 7 % N-(2-cyanoethyl) ethylenediamine;
about 24 % propylene glycol monomethyl ether;
about 30 % de-ionized water; and
about 1 % ammonium tetraborate;

Formulation D

about 8 % NH₄F/HF;
about 30 % hydroxyethylmorpholine;
about 7 % N-(2-cyanoethyl) ethylenediamine;
about 15 % propylene glycol monomethyl ether;
about 40 % de-ionized water; and
about 0.10 % alkyl EOPO amine oxide surfactant;

Formulation E

about 8 % NH₄F/HF;
about 30 % hydroxyethylmorpholine;
about 7 % N-(2-cyanoethyl) ethylenediamine;
about 15 % propylene glycol monomethyl ether;
about 40 % de-ionized water; and
about 0.10 % EO octylphenol surfactant; and

Formulation F

about 8 % NH₄F/HF;
about 30 % hydroxyethylmorpholine;
about 7 % N-(2-cyanoethyl) ethylenediamine;
about 15 % propylene glycol monomethyl ether;
about 40 % de-ionized water; and

about 0.10 % EO nonylphenol surfactant;

wherein the total of the weight percentages of such components of the composition does not exceed 100 % by weight.

16. (Currently amended) The composition of claim 4-1, comprising the following components, based on total weight of the composition:

~~5.0 % wt. - 10.0~~ 0.1 % wt. - 15.0 % wt. fluoride source;

~~35.0~~ 20.0 % wt. - 40.0 60.0 % wt. total organic amine;

~~10.0 % wt. - 30.0~~ 1.0 % wt. - 60.0 % wt. total organic solvent;

~~25.0 % wt. - 45.0~~ 20.0 % wt. - 70.0 % wt. water;

0.000 % wt. - 20.0 % wt. chelating agent; and

~~0.05 % wt. - 0.10~~ 0.000 % wt. - 5.0 % wt. surfactant,

wherein the total of the weight percentages of such components of the composition does not exceed 100 % by weight.

17. (Currently amended) The composition of claim 2-1, wherein the pH of the composition is in a range from about 5 to about 9.

18. (Original) A method of removing photoresist, BARC material, and/or gap fill material from a substrate having said material(s) thereon, said method comprising contacting the substrate with an aqueous-based removal composition for sufficient time to at least partially remove said material from the substrate, wherein the aqueous-based removal composition includes a fluoride source, at least one organic

amine, at least one organic solvent, water, optionally at least one chelating agent, and optionally at least one surfactant.

19. (Canceled)

20. (Original) The method of claim 18, wherein the substrate comprises a semiconductor device structure.

21.-24. (Canceled)

25. (Original) The method of claim 18, wherein said contacting is carried out for a time of from about 1 minute to about 5 minutes.

26. (Original) The method of claim 18, wherein said contacting is carried out at temperature in a range of from about 20°C to about 40°C.

27. (Currently Amended) The method of claim 19 18, wherein the fluoride source comprises a fluoride-containing compound selected from the group consisting of ammonium fluoride, hydrogen fluoride, ammonium bifluoride, tetraalkylammonium difluoride, alkyl phosphonium difluoride, and triethylamine trihydrofluoride.

28. (Currently amended) The method of claim 19 18, wherein the fluoride source at least one organic amine comprises ammonium fluoride N-(2-cyanoethyl)ethylenediamine.

29. (Currently amended) The method of claim 19 28, wherein the aqueous-based removal composition further comprises at least one additional organic amine comprises an amine containing compound selected from the group consisting of hydroxyethylpiperazine, hydroxypropylpiperazine, aminoethylpiperazine, aminopropylpiperazine, hydroxyethylmorpholine, hydroxypropylmorpholine,

~~aminoethylmorpholine, aminopropylmorpholine, triethanolamine, pentamethyldiethylenetriamine, dimethylaminoethoxyethanol, aminoethoxyethanol, ethylene urea, trimethylaminoethylmethanolamine, trimethylaminopropylethanolamine, N-(2-cyanoethyl) ethylenediamine, and N-(2-cyanopropyl) ethylenediamine.~~

30. (Currently Amended) The method of claim 49 29, wherein the at least one additional organic amine comprises an amine-containing compound selected from the group consisting of hydroxyethylmorpholine and N-(2-cyanoethyl hydroxyethylpiperazine, hydroxypropylpiperazine, aminoethylpiperazine, aminopropylpiperazine, hydroxyethylmorpholine, hydroxypropylmorpholine, aminoethylmorpholine, aminopropylmorpholine, triethanolamine, pentamethyldiethylenetriamine, dimethylaminoethoxyethanol, aminoethoxyethanol, ethylene urea, trimethylaminoethylmethanolamine, trimethylaminopropylethanolamine, and N-(2-cyanopropyl) ethylenediamine.

31. (Currently amended) The method of claim 49 18, wherein the at least one organic solvent comprises a compound selected from the group consisting of 1,4-butanediol, 1,3-butanediol, ethylene glycol, propylene glycol, N-methyl-2-pyrrolidone, DMSO, γ -butyrolactone, propylene glycol monomethyl ether, propylene glycol monomethyl ether acetate, diethyleneglycol monobenzylether, ethyl lactate, ammonium lactate, and dimethyl acetamide.

32. (Canceled)

33. (Currently amended) The method of claim 49 18, comprising at least one chelating agent selected from the group consisting of iminodiacetic acid, boric acid, ammonium borate, ammonium tetraborate, gluconic acid, mannitol, and sorbitol.

34. (Canceled)

35. (Currently amended) The method of claim 49 18, comprising at least one surfactant selected from the group consisting of: (C₁-C₁₅) alkyl glucosides; (C₁-C₁₅) alkyl ethylene oxide/propylene oxide; (C₁-C₁₀) alkyl phenoxy ethylene oxide/propylene oxide; and oxirane, methyl-, polymer with oxirane, ether with 2, 2'-(oxidoimino)bis(ethanol) (2:1) and N(-3-(C(-11-isoalkyloxy)propyl) derivatives.

36.-38. (Canceled)

39. (Currently amended) The method of claim 49 18, selected from the group consisting of Formulations A-E F, wherein all percentages are by weight, based on total weight of the formulation:

Formulation A

about 8 % NH₄F/HF;
about 30 % hydroxyethylmorpholine;
about 7 % N-(2-cyanoethyl) ethylenediamine;
about 15 % propylene glycol monomethyl ether;
about 40 % de-ionized water; and
about 0.05 % decyl glucoside;

Formulation B

about 8 % NH₄F/HF;
about 30 % hydroxyethylmorpholine;
about 7 % N-(2-cyanoethyl) ethylenediamine;
about 25 % propylene glycol monomethyl ether; and
about 30 % de-ionized water;

Formulation C

about 8 % $\text{NH}_4\text{F}/\text{HF}$;
about 30 % hydroxyethylmorpholine;
about 7 % N-(2-cyanoethyl) ethylenediamine;
about 24 % propylene glycol monomethyl ether;
about 30 % de-ionized water; and
about 1 % ammonium tetraborate;

Formulation D

about 8 % $\text{NH}_4\text{F}/\text{HF}$;
about 30 % hydroxyethylmorpholine;
about 7 % N-(2-cyanoethyl) ethylenediamine;
about 15 % propylene glycol monomethyl ether;
about 40 % de-ionized water; and
about 0.10 % alkyl EOPO amine oxide surfactant;

Formulation E

about 8 % $\text{NH}_4\text{F}/\text{HF}$;
about 30 % hydroxyethylmorpholine;
about 7 % N-(2-cyanoethyl) ethylenediamine;
about 15 % propylene glycol monomethyl ether;

about 40 % de-ionized water; and
about 0.10 % EO octylphenol surfactant; and

Formulation F

about 8 % NH₄F/HF;
about 30 % hydroxyethylmorpholine;
about 7 % N-(2-cyanoethyl) ethylenediamine;
about 15 % propylene glycol monomethyl ether;
about 40 % de-ionized water; and
about 0.10 % EO nonylphenol surfactant;

wherein the total of the weight percentages of such components of the composition does not exceed 100 % by weight.

40. (Currently Amended) The method of claim 35 18, wherein the composition comprises comprising the following components, based on total weight of the composition:

5.0 % wt. – 10.0 0.1 % wt. – 15.0 % wt. fluoride source;
35.0 20.0 % wt. – 40.0 60.0 % wt. total organic amine;
10.0 % wt. – 30.0 1.0 % wt. – 60.0 % wt. total organic solvent;
25.0 % wt. – 45.0 20.0 % wt. – 70.0 % wt. water;
0.000 % wt. – 20.0 % wt. chelating agent; and
0.05 % wt. – 0.10 0.000 % wt. – 5.0 % wt. surfactant,

wherein the total of the weight percentages of such components of the composition does not exceed 100 % by weight.

41. (Currently amended) The method of claim ~~19~~ 18, wherein the pH of the composition is in a range from about 5 to about 9.

42. (Original) The method of claim 18, further comprising contacting the substrate with deionized water following contact with the aqueous-based removal composition.

43. (Currently Amended) The method of claim 18, further comprising residue material selected from the group consisting of photoresist, BARC materials, gap fill materials, and combinations thereof inspecting the substrate by optical microscopy and determining therefrom the removal efficiency of the aqueous-based removal composition.

44. (New) The composition of claim 1, wherein the at least one additional organic amine comprises an amine-containing compound selected from the group consisting of hydroxyethylpiperazine, hydroxypropylpiperazine, aminoethylpiperazine, aminopropylpiperazine, hydroxyethylmorpholine, hydroxypropylmorpholine, aminoethylmorpholine, aminopropylmorpholine, triethanolamine, pentamethyldiethylenetriamine, dimethylaminoethoxyethanol, aminoethoxyethanol, ethylene urea, trimethylaminoethylethanamine, trimethylaminopropylethanamine, and N-(2-cyanopropyl) ethylenediamine.

45. (New) The method of claim 18, wherein the at least one additional organic amine comprises an amine-containing compound selected from the group consisting of hydroxyethylpiperazine, hydroxypropylpiperazine, aminoethylpiperazine, aminopropylpiperazine, hydroxyethylmorpholine, hydroxypropylmorpholine, aminoethylmorpholine, aminopropylmorpholine, triethanolamine, pentamethyldiethylenetriamine, dimethylaminoethoxyethanol, aminoethoxyethanol, ethylene urea,

trimethylaminoethylethanolamine, trimethylaminopropylethanolamine, N-(2-cyanoethyl)ethylenediamine, and N-(2-cyanopropyl)ethylenediamine.